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Client Ref. : 2657 US  
Our Ref. : 71205



US007025558B2

(12) **United States Patent**  
**Blotenberg**

(10) **Patent No.:** **US 7,025,558 B2**  
(45) **Date of Patent:** **Apr. 11, 2006**

(54) **PROCESS FOR THE RELIABLE OPERATION OF TURBOCOMPRESSORS WITH SURGE LIMIT CONTROL AND SURGE LIMIT CONTROL VALVE**

5,960,624 A 10/1999 Blotenberg  
6,164,901 A 12/2000 Blotenberg  
6,193,470 B1 2/2001 Aurbeck  
2001/0022938 A1 9/2001 Blotenberg  
2002/0062679 A1 5/2002 Petrosov

(75) **Inventor:** **Wilfried Blotenberg, Dinslaken (DE)**

**FOREIGN PATENT DOCUMENTS**

(73) **Assignee:** **Man Turbo AG, Oberhausen (DE)**

DE 35 40 087 A1 5/1987  
DE 35 44 822 A1 6/1987  
DE 38 09 881 C2 5/1990  
DE 689 16 555 T2 10/1994

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 67 days.

(Continued)

(21) **Appl. No.:** **10/763,103**

*Primary Examiner*—Edward K. Look  
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(22) **Filed:** **Jan. 22, 2004**

(74) *Attorney, Agent, or Firm*—McGlew & Tuttle, P.C.

(65) **Prior Publication Data**

US 2004/0151576 A1 Aug. 5, 2004

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Jan. 31, 2003 (DE) ..... 103 04 063

(51) **Int. Cl.**  
**F04D 27/02** (2006.01)

(52) **U.S. Cl.** ..... **415/1; 415/17**

(58) **Field of Classification Search** ..... **415/1, 415/17, 30, 36, 159, 160, 163**

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

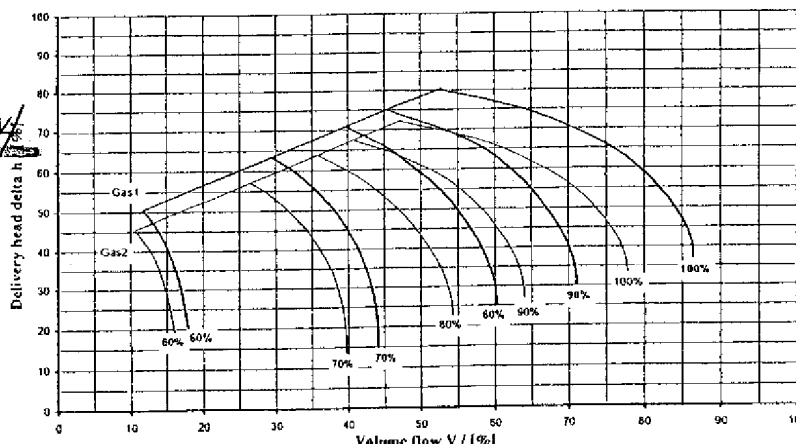
4,148,191 A \* 4/1979 Frurschi ..... 60/652  
4,810,163 A 3/1989 Blotenberg  
4,825,380 A 4/1989 Hobbs  
4,831,535 A \* 5/1989 Blotenberg ..... 415/1  
4,946,343 A 8/1990 Blotenberg  
4,949,276 A 8/1990 Staroselsky et al.  
5,195,875 A 3/1993 Gaston  
5,290,142 A 3/1994 Ispas et al.  
5,743,715 A \* 4/1998 Staroselsky et al. .... 415/1  
5,765,991 A 6/1998 Blotenberg  
5,908,462 A 6/1999 Batson

A process for the reliable operation of turbocompressors with a surge limit control and a surge limit control valve is described, in which the compressor delivers gases with different compositions and the composition of the gas (molecular weight) affects the performance characteristic of the turbocompressor and hence the position of the surge limit in the performance characteristic. The different compositions of the gases are compensated here with the effect on the position of the surge limit and consequently on the position of the surge limit control line by using predetermined design values for the gas constant R, the isentropic exponent k and the compressibility number z within the surge limit control for the determination of the delivery head  $\Delta h$  and the volume flow V and plotting them in the form of a predetermined surge limit line (FIG. 2, FIG. 4), wherein the set point and the actual value are determined for the surge limit control from the graph, and the compressor is operated with the set points and actual values determined for the surge limit control with a minimally necessary distance from the surge limit.

**4 Claims, 7 Drawing Sheets**

**LARGE ENTRY**

**EXPIRES 07-14-2014**



## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page \_\_\_\_\_ of \_\_\_\_\_

PATENT NO. : US 7,025,558

APPLICATION NO.: 10/763,103

ISSUE DATE : April 11, 2006

INVENTOR(S) : Wilfried Blotenberg

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

The Letters Patent that issued incorrectly listed the name of the Assignee as Man Turbo AG.

The correct name of the Assignee as shown on the Issue Fee Form showed the name as MAN TURBO AG.

The correct name to be listed for the Assignee on the Letters Patent is MAN TURBO AG.

### MAILING ADDRESS OF SENDER (Please do not use customer number below):

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Scarborough, New York 10510-9227

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